Filled in

Chapter 4 Notes – Roots and Powers

DOUBLE ENTRY NOTETAKER

Look through pages 202 – 249 in your textbook. As you read make notes on things you think you know. Does a word or phrase look familiar? Have you seen some of the symbols before? Do you remember doing similar questions in the past? Also, while you read jot-down things that you may be wondering. Perhaps a specific term is unfamiliar and you'd like to know what it means. Or something your read leaves you wanting to know more. Write it down.

What I think I know….	What I wonder…

4.2 – NUMBER SYSTEMES AND APPROXIMATING IRRATIONALS (p. 207)

Natural numbers, N, are all positive integers starting at 1
ie. N = {1, 2, 3, . . . } "counting numbers"

Whole numbers, W (or No), are all positive integers and 0.

ie. W = {0, 1, 2, 3, . . . }

Integers, Z (sometimes ±), are whole numbers and their opposites.

ie. Z = {. . . -2, -1, 0, 1, 2, . . . } (positive and negative whole #s + 0)

Rational numbers, Q, are any numbers written in the form of a fraction, $\frac{a}{b}$, where a & b are integers and b ≠ 0

ie. $Q = \left\{\frac{a}{b} \middle| b \in \mathbb{Z}, b \neq 0\right\}$ (includes repeating decimals)

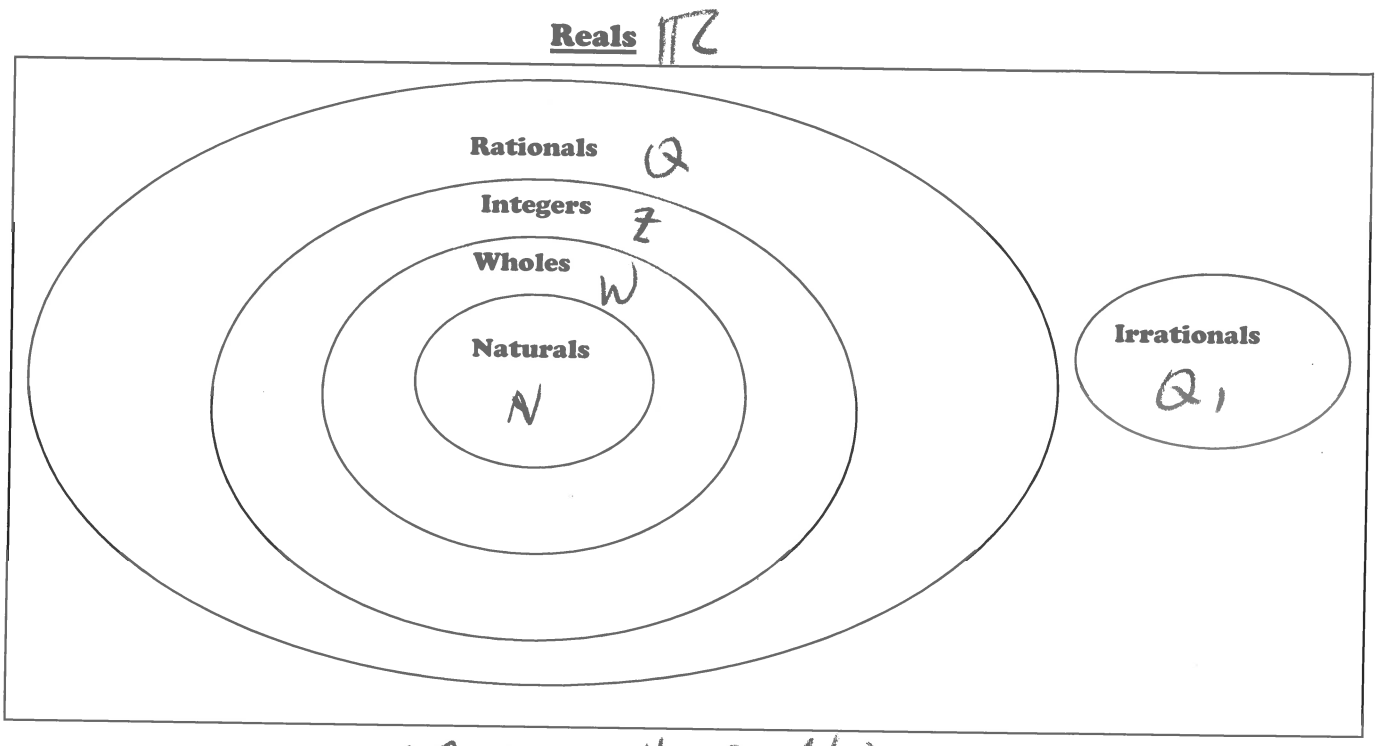
Irrational numbers, Q' or $\bar{Q}$ or I or Ir!, are any number that cannot be written in the form $\frac{a}{b}$, where a & b are integers and b ≠ 0. (includes non-repeating decimals)

Q' = Set of irrational numbers

Real numbers, $\mathbb{R}$, are the Union of the rational number set *and* the irrational number set.

ie. R = Q U Q'

(In basic mathematics, a number divided by zero isn't a number. **It isn't rational or irrational.** We call it "undefined". On your calculator, dividing by zero gives you an "error".)



(They're all Real!)

Examples: 1. Which Number System *best* represents the following numbers (ie in which number system does it first appear?)

a) 2 ____N____ b) 0.25 ____Q____ $\frac{25}{100}$

c) $\sqrt{35}$ ____Q'____ d) -5 ____Z____

repeating decimals can be written as fractions

e) π ____Q'____ f) 0.131313... ____R____ $= \frac{13}{99}$

g) $\sqrt{25} = 5$ ____N____ h) 0 ____W____

i) 0.123456789... ____Q'____ j) $\frac{3}{4}$ ____Q____

f) 5 decimals

$100x = 13.1313...$
$x = 0.1313...$
$99x = 13$
$\frac{99x}{99} = \frac{13}{99}$
$x = \frac{13}{99}$

2. Write each number in decimal form (round to 2 decimal places). Some may already be written in decimal form.

a) 3 3.00

b) 0.41 0.41

c) $\sqrt{45}$ 6.71 (6.708 ← 5 or bigger, change to 1)

d) -3 -3.00

e) π 3.14

f) 0.171717... 0.17

g) $\sqrt{16}$ 4.00

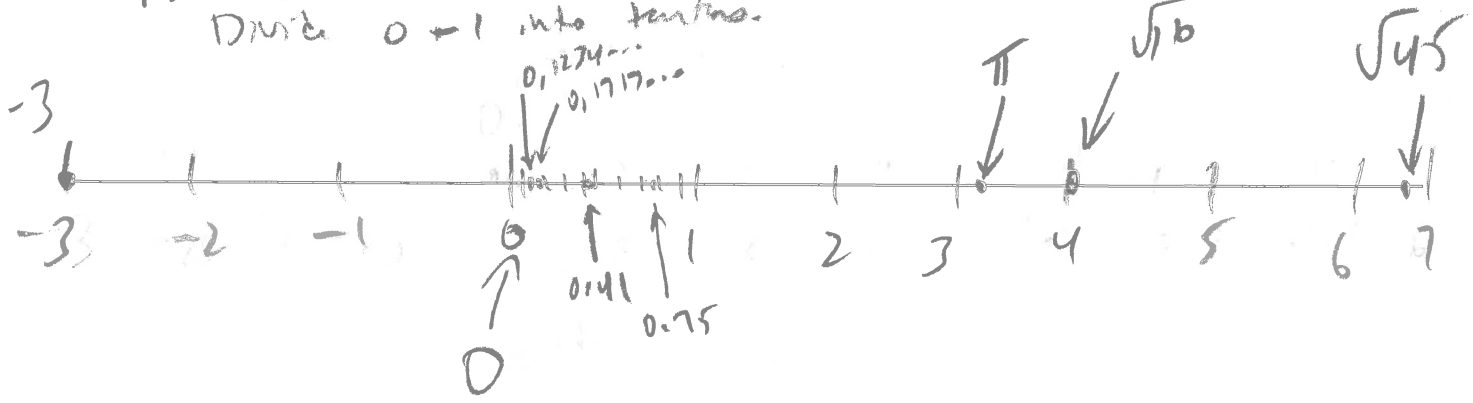
h) 0 0.00

i) 0.123456789... 0.12

j) $\frac{3}{4}$ 0.75

Place the original numbers from above (not the decimal numbers) on a horizontal number line (below). Clearly label the number line and use an appropriate scale.

Fill up the space - evenly spaced intervals.
Put a dot on line. Draw arrow to point.
Don't do 0 → 1 into thirds.



Roots and Cubes

A number that has <u>two equal factors</u> is called ***perfect square***. (example *7 x 7 = 49*, and therefore *49* is a perfect square). **ONE of the equal factors** is called the ***square root*** of that number. So because 49 = *7 x 7, then 7 is ONE of the equal factors.. and therefore is the square root of 49.*

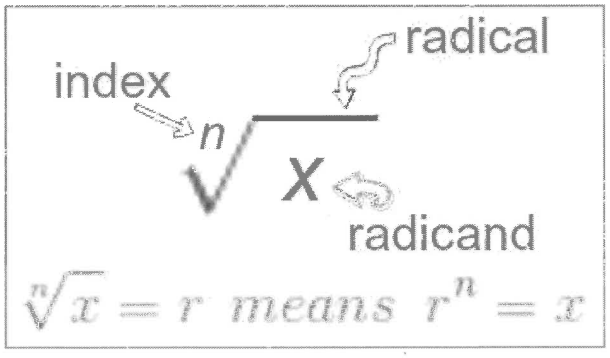
Similarly, a number that is multiplied by itself *three* times to produce a ***perfect cube*** number is called the ***cube root*** of that number. *For example, if 5 x 5 x 5 = 125, then 125 is a perfect cube and the cube root of 125 is 5.*

The mathematical symbol used to represent a **square root** is: $\sqrt[2]{\ }$ or just $\sqrt{\ }$

The mathematical symbol used to represent a **cube root** is: $\sqrt[3]{\ }$

Write the symbol for a fourth root: _____

Vocabulary:



Practice using your calculator:

Radical	Value	Is the Value Exact or Approximate?
$\sqrt{16}$	4	Exact $16 = 4 \cdot 4 \therefore \sqrt{16} = 4$
$\sqrt{27}$	5.1962...	Approximate
$\sqrt{\frac{16}{81}}$	$\frac{4}{9}$ or $0.\overline{4}$	Exact $\frac{16}{81} = \frac{4}{9} \cdot \frac{4}{9} \therefore \sqrt{\frac{16}{81}} = \frac{4}{9}$
$\sqrt{0.64}$	0,8	E
$\sqrt[3]{16}$	2.519...	A
$\sqrt[3]{27}$	3	E $27 = 3 \cdot 3 \cdot 3 \leftarrow \therefore 3 = \sqrt[3]{27}$
$\sqrt[3]{\frac{16}{81}}$	0,5823...	A
$\sqrt[3]{0.64}$	0.8617...	A
$\sqrt[3]{-0.64}$	-0.8617...	A
$\sqrt[4]{16}$	2	E $16 = 4 \cdot 4 \cdot 4 \cdot 4 \therefore 4 = \sqrt[4]{16}$
$\sqrt[4]{27}$	2.279...	A
$\sqrt[4]{\frac{16}{81}}$	$\frac{4}{3}$	E $\frac{16}{81} = \left(\frac{2}{3}\right)\left(\frac{2}{3}\right)\left(\frac{2}{3}\right)\left(\frac{2}{3}\right) \therefore \sqrt[4]{\frac{16}{81}} = \frac{2}{3}$
$\sqrt[4]{0.64}$	0.9889...	A

So far, all examples have looked at perfect square and cube numbers with whole number (positive integer) roots. However, **roots may be negative integers as well.**

Example: $7 \times 7 = 49$ and $-7 \times -7 = 49$

Therefore, the square root of 49 may be 7 or -7, and expressed as: $\sqrt{49} = \pm 7$

Because perfect square numbers are ***always*** positive numbers, you **cannot take the square root of a negative number.** So, $\sqrt{-169}$ does not have a real number solution.

What happens when you cube a negative number?

Example: $(-3)(-3)(-3) = -27$

The **product of three negative numbers is also a negative number**. Therefore, it is possible to find the **cube root of a negative number**, as well as of positive numbers.

So: $\sqrt[3]{-27} = -3$ and $\sqrt[3]{27} = 3$

Homework for tomorrow: _____